ORIGINAL ARTICLE

Incidence of Measles with Disease Manifestations in Infants: Do Infants Need Measles Vaccine Earlier than 9 Months?

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ABSTRACT

Objective: To find out the incidence of measles with disease manifestations in infants equal to and less than 9 months of age.

Study Design: It was a descriptive cross-sectional study based on secondary data analysis.

Place and Duration of Study: It was carried out at Cantonment General Hospital Department of Paediatrics from 1st January 2023 to 30th September 2023 (9 months).

Materials and Methods: It was a secondary data analysis of all records collected of expanded programme of immunization from Rawalpindi District, Punjab from 1st January 2023 to 30th September 2023. Data included all infants equal to and less than 9 months of age of both genders presenting with signs and symptoms of measles. Infants with positive measles serum IgM antibodies were labelled as confirmed measles cases. Data was analyzed using windows SPSS version 24.0. Results described in both in frequencies and percentages.

Results: In our study total of 470 infants were enrolled. Out of which 294(62.6%) were measles IgM positive. Of the total cases, 182 (61.9%) were male and 112 (38.1%) were female. Among them, 20 (6.8%) were vaccinated, whereas 274 (93.2%) were unvaccinated. Age wise distribution showed that IgM positive cases at 1,2,3,4,5,6,7,8,9 months were 3(1%), 4(1.4%), 16(5.4%), 19(6.%%), 33(11.2%), 52(17.7%), 52(17.7%), 81(27.6%), 34(11.6%) respectively. Common symptoms seen were fever 294(100%), cough 287(97.6%), coryza 95((32.3%), conjunctivitis 41(13.9%), rash 294(100%). Complications were seen in 41(13.9%) with mortality of 5(1.7 %).

Conclusion: We conclude that a significant number of infants are being infected with measle virus before reaching the age of first recommended vaccine inoculation against measles. It is affecting children as young as one month old.

Key Words: *Infants, Immunity, Measles, Measles IgM Antibodies, Vaccine.*

Introduction

Measles is highly contagious disease caused by measles virus and carries high morbidity and mortality among children under 5 years of age.[1] It affects around 30 million of people annually with around 0.5 million deaths.[2] Around two third of these mortalities occur in Pakistan. Highest death rate of almost around 10 % seen in areas with high prevalence of malnutrition, poor vaccination practices and non availability of health facilities.[3,4] Maternal antibodies usually persists till 15 months of age but recent research showed that maternal antibodies protect only from 3 to 4 months of age and are not detectable in blood in most of infants at age of 6 months. [4,5] Breastfeeding provides secretory IgA and other immune factors that offer partial protection against measles in early infancy; however, it does not sustain protective antibody titres, making vaccination essential for long-term immunity. Most commonly encountered disease complications are pneumonia, encephalitis, optic neuritis, gastroenteritis and meningitis. [5,6]

Disease control relies on vaccination. WHO recommends vaccination at 9 months of age in high risk areas, however in very high risk areas vaccination as early as 6 months of age has been

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Received: October 19, 2024; Revised: September 13, 2025
Accepted: September 23, 2025

https://doi.org/10.57234/jiimc.september25.2292

explored in regions like Nitherland, East & West Africa.[6,7,8] Low birth weight infants having diminished maternal antibodies and malnourished infants are highly susceptible to disease related complications & early vaccination can be helpful in such infants.[7,8] In Pakistan vaccine is given according to expanded programme of immunization at 9 months of age and 15 months of age. Introduction of measles vaccine led to decline in cases. Vaccine is free of cost, effective with rare side effects.[9] Studies showed that infants vaccinated at 6 months of age generates a primary immune response & provide protection in high risk environment & is safe with similar adverse events observed in older infants.[10]

Loachlain LM et. al,[11] conducted on measles vaccination effects below 9 months of age and concluded that administering vaccine below 9 months of age resulted in increase vaccine effectiveness and T cell response with high seropositivity.

Detection of measles-specific IgM antibody remains the gold standard for laboratory confirmation of measles. It provides high sensitivity and specificity, particularly when obtained within the first few days after rash onset. The presence of IgM strongly supports acute infection, helping to differentiate measles from other exanthematous illnesses. Its reliability and rapid availability make IgM serology the cornerstone of measles diagnosis in both clinical and epidemiological settings.

Rationale of the study is that with increasing measles outbreak each year, study will help authorities to revise recommended age of vaccination. Due to high morbidity and mortality associated with it and grave complications of disease vaccine is only way to prevent disease. In developing countries like Pakistan, where population density is high, number of unvaccinated children and continuously migrating population is also high. Outbreaks are observed in infants less than 9 months of age. The aim of study was to find incidence of measles in infants below 9 months to decrease recommended age of vaccine.

Materials and Methods

It was a descriptive cross-sectional study based on secondary data analysis of all expanded programme of immunization records collected from Rawalpindi District, Punjab from 1st January 2023 to 30th September 2023. The study was conducted across 21 healthcare centers, including all major public sector hospitals within the Rawalpindi district as well as selected private hospitals and pediatric clinics. Approval was taken from ethical committee reference no admin/321-A/22/15/2022. Data included all children equal to and less than 9 months of age of both genders presenting with signs and symptoms of measles. All infants ≤9 months of age presenting with clinical suspicion of measles were enrolled. Blood samples were taken, and IgM testing was performed. Cases with positive IgM antibodies were labelled as confirmed measles. Any child in whom clinician suspects measles infection or any child with fever and maculopapular rash, severe cough and coryza or conjunctivitis was labelled as suspected case of measles. Infants fulfilling operational definition of measles were enrolled and 3 ml of blood specimen was collected using sterile method during 4th to 28th day of rash onset for IgM test and stored in cold chain of 2 to 8 °C. The sample was properly labeled and accompanied by the surveillance report from the respective health facility. It was submitted to the District Health Authority Office, Rawalpindi, and subsequently forwarded to the National Institute of Health (NIH), Islamabad, where laboratory testing was performed. Infants with positive measles serum IgM antibodies were labelled as confirmed measles cases. Data was analyzed using SPSS version 24.0. Frequency of disease in infants equal to and under the age of 9 months was calculated. Results were described in terms of frequencies as well as percentages.

Results

A total of 470 infants were enrolled in the study, of whom 294 (62.6%) were confirmed measles IgM positive. Among these, 182 (61.9%) were male and 112 (38.1%) were female. The majority of cases, 274 (93.2%), were unvaccinated, while only 20 (6.8%) had received measles vaccination, till 9 months of age single dose of measles vaccine is given as shown in Table I & Figure 1.

Age-stratified analysis revealed that IgM positive cases were observed as early as one month of age. The highest frequency was noted at 8 months (81; 27.6%), followed by 6 and 7 months (52 each; 17.7%). The lowest frequency occurred at 1 month (3; 1.0%) as shown in Figure 2.

The most common symptoms among IgM positive

infants were fever (294; 100%), rash (294; 100%), cough (287; 97.6%), coryza (95; 32.3%), and conjunctivitis (9; 3.1%) as shown in Table II.

Complications were documented in 41 infants (13.9%), predominantly pneumonia and encephalitis. There were 5 deaths (1.7%) recorded among IgM positive cases and cause of death was pneumonia & encephalitis as shown in Table III.

Chi-square test was applied to assess associations between age groups, gender, vaccination status, and measles positivity. The association between vaccination status and measles infection was statistically significant ($p < 0.05$).

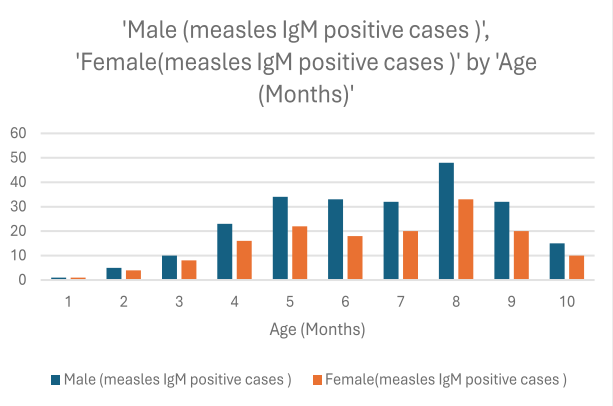

Figure 1: Gender Distribution of Measles IgM Positive Cases N=294

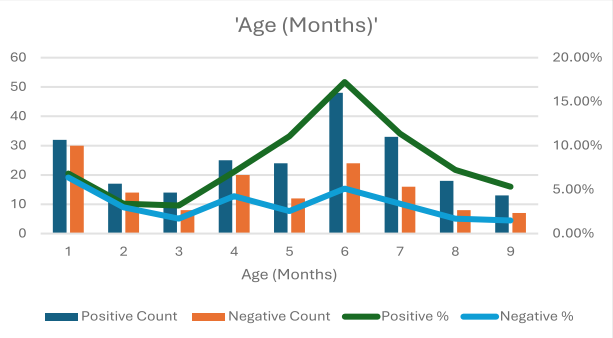

Figure 2: Age Wise Distribution of Measles IgM Positive & Negative cases. N=470

Table I: Measles IgM positive demographics gender, vaccination status, : N=294

Measles IgM Positive		Frequency	Percent(%)
Gender			
	Male	182	61.9%
	Female	112	38.1%
Vaccination Status			
	Not vaccinated	274	93.2%
	Vaccinated(single dose)	20	6.8%

Table II: Clinical Features Among Measles Igm Positive Infants (n=294)

Symptoms	Frequency	Percentage (%)
Fever	294	100.0%
Rash	294	100.0%.
Cough	287	97.6%
Coryza	95	32.3%
Conjunctivitis	9	3.1%

Table III: Complications and Outcomes Among Measles IgM Positive Infants (n=294)

	Frequency	Percentage (%)
Pneumonia/Encephalitis	41	13.9
Mortality	5	1.7

Discussion

In this study, 470 infants with clinical suspicion of measles were enrolled, and IgM testing was performed for all. Of these, 294 (62.6%) were laboratory confirmed as measles IgM positive. The results demonstrated a clear male predominance (61.9%) and higher disease frequency among unvaccinated infants (93.2%). The significant association between vaccination status and measles infection ($p < 0.05$) emphasizes the critical role of immunization in preventing infection. Gianniki et. al.,[12] reported a similar gender distribution with male predominance (55.7%) and highlighted the importance of vaccination coverage and surveillance, findings that align with our observations.

When analyzing age distribution, a rising trend in measles positivity was observed beyond five months of age peaking at eight months (27.6%). Although cases were documented as early as one month of age, the most affected group was between six and eight months. This trend correlates with waning maternal antibody levels after three to four months of age as described by previous studies.[4,5] Jamal et. al.,[13] observed similar age-specific vulnerability and highlighted the need for considering earlier vaccination strategies. The persistence of infections before the first scheduled dose at nine months underscores a potential window of susceptibility requiring programmatic attention.

Gender-based and sociocultural factors likely influenced Healthcare seeking behavior. Jamal etal., suggested that female children are less frequently presented to health facilities, which may partially

https://doi.org/10.57234/jiimc.september25.2292

explain the higher representation of males in our cohort.[13] Such disparities emphasize the need for community education and equitable healthcare access.

The post-COVID-19 period may have exacerbated measles transmission dynamics. Asghar etal., reported a 30% incidence among children aged six to nine months, while our study showed a higher positivity rate (63%), potentially due to reduced vaccination coverage during pandemic-related disruptions and increased population movement[14] Strengthened surveillance systems introduced in recent years may also have contributed to improved case detection.

The study also revealed that complications occurred in 13.9% of IgM positive infants, with pneumonia and encephalitis being predominant, and an overall mortality of 1.7%. Sindhu et. al.,[15] similarly reported higher complication rates in infants compared to older children. The findings are consistent with evidence that measles-related morbidity is aggravated by immune suppression and secondary infections, as discussed by Bogler et. al.,[16] and Muhammad et. al.,[17]

The Importance of vaccination is further highlighted by global studies. Fisker et. al.,[18] observed improved antibody responses and reduced mortality with early measles vaccination and Zucker et. al.,[19] noted that undervaccination was associated with outbreaks and hospitalization. These observations reinforce the study's conclusion that timely vaccination remains the cornerstone of measles control.

Finally, the rising incidence observed from five to nine months of age supports the notion of declining maternal immunity and the critical vulnerability window preceding the first vaccine dose.[4,5] Similar findings were reported by Welaga et. al.,[21] Lo Vecchio et. al.,[22] and Patel et. al.,[23] who emphasized strengthening immunization programs and possibly revisiting vaccination schedules in high-risk settings.

This district-level analysis, encompassing public and private healthcare facilities, is among the first in Punjab to quantify measles burden in infants below nine months. Although limited by its geographic scope, it provides valuable insights to policymakers for optimizing vaccination timing and strategies.

Conclusion

We conclude that a significant number of infants are being infected with measles before reaching the age of first recommended vaccine inoculation against measles. It is affecting children as young as one month old.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors have declared no specific grant for this research from any funding agency in public, commercial or nonprofit sector.

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.